Int Surg 2014;**99:**17–22
DOI: 10.9738/INTSURG-D-13-00137.1

Safe Transanal Tumor Resection Using a Harmonic Scalpel

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We performed a safe and simple transanal tumor resection involving total layer resection using a harmonic scalpel as a resecting device. Here we report the results of our experience with this technique between 2005 and 2011. This study involved 32 patients who underwent transanal tumor resection using a harmonic scalpel. The subjects comprised 18 men and 14 women ranging in age from 34 to 87 years (mean: 64.5 years). The tumors measured 8 to 70 mm (mean: 31 mm) in diameter. The operation took 7 to 86 minutes (mean: 29 minutes), and the amount of bleeding was 0 to 165 mL (mean: 16.2 mL). There was no intraoperative blood loss that necessitated hemostatic procedures. Histopathologically, the lesions included hyperplastic polyp in 1 case, adenoma in 9, carcinoma in situ in 7, submucosal invasive cancer in 6, muscularis propria cancer in 4, carcinoid in 1, malignant lymphoma in 1, gastrointestinal stromal tumor in 1, mucosal prolapsed syndrome in 1, and mucosa-associated lymphoid tissue lymphoma in 1. With our technique, en bloc resection was achieved in all patients, and the use of a harmonic scalpel enabled us to complete the operation within 30 minutes, on average, without intraoperative bleeding.

Key words: Rectal tumor – Transanal tumor resection – Harmonic scalpel

With technical developments and advances in colonoscopic diagnosis, such as magnifying endoscopy[1–3] and the narrow band imaging system,[4,5] and ablative surgery, such as endoscopic mucosal resection (EMR)[1,6] and endoscopic submucosal dissection (ESD),[7] cures have become achievable with endoscopic resection (ER) alone in many cases of early colorectal carcinoma. ER is the treatment of choice for early colorectal carcinoma. However, with large lesions, conventional EMR cannot be performed as an en bloc resection; and even with lesions smaller than 20 mm in diameter, incomplete resection or piecemeal resection often occurs. After endoscopic piecemeal mucosal resection, histopathological assessment of complete resection is difficult and the risk of local recurrence is high.[8] ESD has also

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Fig. 1 E-type anal retractor (Yufu Itonagan Co Ltd) is a three-bladed device with a cylinder that allows for smoother insertion into the anus.

been used to treat large colorectal adenomas, with recurrence rates of 0 to 9% and complication rates of only 0 to 9%.[9–11] However, compared with conventional EMR, the ESD technique is technically challenging and time consuming and requires a steep learning curve.[9,12] In addition, there are some issues involved in ER of lower rectal neoplastic lesions. Specifically, ER of these lesions is associated with higher risk of postoperative bleeding than that of lesions at other sites, because the rectum has abundant blood flow, and resection of some lower rectal lesions causes pain because of the sensory nerve distribution in this area.

On the other hand, spread of laparoscopic surgery for colorectal cancer has led to a marked improvement of the quality of life (QOL) of these patients after resection,[13,14] and the incidence of lymph node metastasis in cases of submucosal invasive (SM) cancer is as low as about 10%.[15–18] Taking these into account, radical surgical resection, including abdominoperitoneal resection that requires a permanent stoma, seems to be excessively invasive in cases of early colorectal cancer. Recent years have seen great benefits of surgical treatment for lower rectal cancer, because intersphincteric resection (ISR)[19] has become more common, allowing sphincter-preserving surgery even in patients in whom creation of a permanent stoma would have otherwise been required. The feasibility of ISR under laparoscopy has also improved the postoperative QOL.[20] However, even at present, the QOL is not necessarily satisfactory in terms of bowel function. In this regard, transanal tumor resection is a useful procedure for tumor removal in some cases, yielding a postoperative QOL comparable with that after EMR.

We perform safe transanal tumor resection involving total layer resection using a harmonic scalpel as a resecting device. Here we report the results of our experience with this technique.

Patients and Methods

This study involved 32 patients who underwent transanal tumor resection using a harmonic scalpel at the Institute of Gastroenterology, Tokyo Women's Medical University, between January 2005 and December 2011.

The indications for surgery included: (1) benign tumors such as adenomas or mild SM or shallower cancer lesions that are unlikely to be associated with lymph node involvement and that may cause bleeding or pain if treated by ER, (2) SM tumors that are difficult to remove by ER, and (3) deeper SM cancer or partial muscularis propria (MP) cancer lesions that are associated with a high risk of lymph node involvement and that are amenable to local resection (involving full-thickness resection) rather than radical intestinal resection accompanied by lymph node dissection because of severe comorbidities or at the patient's request. When there is risk of lymph node metastasis, postoperative chemo-radiotherapy is recommended.

To prepare for surgery, 2 liters of polyethylene glycol electrolyte solution were given orally the day before surgery to carry out intestinal lavage. The operation required general or lumbar anesthesia to obtain relaxation of the anal sphincter during surgery. The body posture used was the lithotomy position in cases of posterior wall lesions, and the jackknife position in cases of anterior wall lesions. To open the anus, a novel E-type anal retractor (Yufu Itonagan Co Ltd, Tokyo, Japan; Fig. 1) or a self-retaining retractor system (Lone Star Retractor System; CooperSurgical, Trumbull, CT; Fig. 2) was used; the latter was more advantageous in cases of lesions located near the anus. Both devices may be tried for anal dilation, with selection of the one that provides a better visual field. The tumor was resected using a harmonic scalpel (Ethicon Endo-Surgery, LLC, Guaynabo, PR) that has better hemostatic properties than the usual electric knife. The anus was dilated to obtain a good visual field, using an E-type anal retractor (Yufu Itonagan Co Ltd) or self-retaining retractor system (CooperSurgical). The key to success was to obtain a frontal view of the lesion. Then, the tumor was cut off with a power device from the anal side of the tumor, while pulling

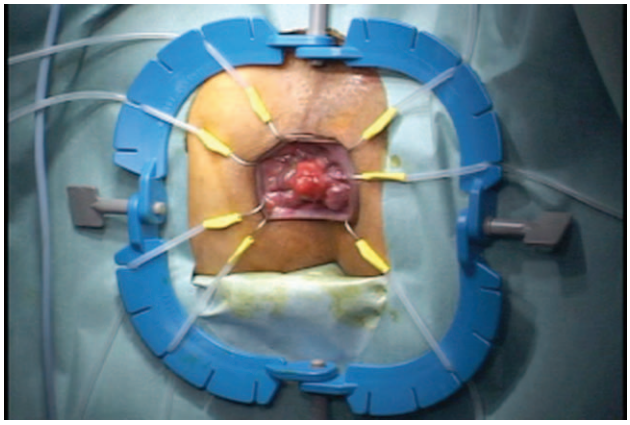

Fig. 2 The anus was dilated to obtain a good visual field using a self-retaining retractor system (CooperSurgical).

up the tumor margin with forceps. Local resection involving total layer resection can be achieved practically without bleeding. After removal of the specimen, the wound area was irrigated with about 1 liter of Isodine solution to prevent tumor cell implantation, and the wound was closed by suturing with absorbable thread. An example case of an 80-year-old man with a IIa+IIc lesion in the lower rectum can be seen in Fig. 3A. The anus was opened with an E-type anal retractor (Yufu Itonagan Co Ltd) to set the lesion in the center (Fig. 3B). The lesion was resected with a harmonic scalpel from the anal side while pulling up the normal mucosa in the proximity of the tumor using forceps. After resection (Fig. 3C), the wound was irrigated with about 1 liter of Isodine solution to prevent tumor cell implantation, and the wound was closed by suturing with absorbable thread.

Results

The subjects comprised 18 men and 14 women ranging in age from 34 to 87 years (mean: 64.5 years). All patients had lower rectal lesions; 22 patients underwent surgery in the lithotomy position and 10 in the jackknife position. The E-type anal retractor (Yufu Itonagan Co Ltd) was used for anal dilation in 23 patients, while the self-retaining retractor system (CooperSurgical) was used in 9. The tumors measured 8 to 70 mm (mean: 31 mm) in diameter. The operation took 7 to 86 minutes (mean: 19 minutes), and the amount of bleeding was 0 to 165 mL (mean: 16 mL). Histopathologically, the lesions included hyperplastic polyp in 1 case, adenoma in 9, carcinoma in situ in 7, SM cancer with SM invasion depth of <1000 μm in 1, SM cancer with SM invasion depth of ≥ 1000 μm in 5, MP cancer in 4, carcinoid in 1, malignant lymphoma in 1, gastrointestinal stromal tumor in 1, mucosal prolapsed syndrome in 1, and mucosa-associated lymphoid tissue lymphoma in 1. The 4 patients with MP cancer underwent transanal tumor resection because of the presence of comorbidity that precluded the use of the conventional surgery ($n = 3$) and a strong preference ($n = 1$). En bloc resection was carried out in all patients and a single-piece specimen was obtained. SM lesions deeper than 1000 μm that were likely to be associated with lymph node metastasis were present in 9 patients. After informed consent was obtained from these patients, chemotherapy was administered to 2 of them, and chemo-radiotherapy to 4, without additional bowel resection accompanied by lymph node dissection. Recurrence was found in 1 case of MP cancer associated with respiratory complications, with metastasis to the pulmonary and inguinal lymph nodes (Table 1).

Discussion

Along with improvement and advances in the techniques of ER, curative resection has been achieved in many cases of colorectal tumors by

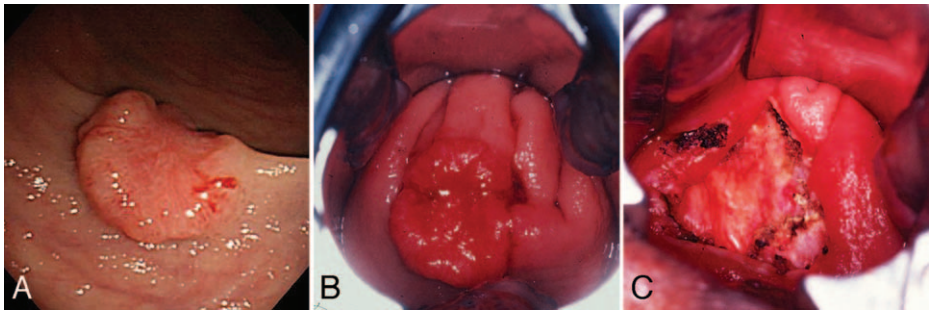

Fig. 3 (A) Colonoscopy showed a IIa+IIc lesion in the lower rectum. (B) The anus was opened with an E-type anal retractor (Yufu Itonagan Co Ltd) to set the lesion in the center. (C) The ulceration after resection using a harmonic scalpel.

Table 1 Results

Sex, n (%)	
Male	18 (56)
Female	14 (44)
Age (y)	34–87 (mean: 64.5)
Position n (%)	
Dorsosacral	22 (69)
Jackknife	10 (31)
Retractor, n (%)	
E-type anal retractor	23 (72)
Lone Star Retractor System™	9 (28)
Tumor size (mm)	8–70 (mean: 31)
Operation time (min)	7–86 (mean: 19)
Blood loss (mL)	0–165 (mean: 16)
Postoperative complication, n (%)	
Bleeding	1 (3%)
Histopathological finding (n)	
Hyperplastic polyp	1
Tubular adenoma	9
Mucosal carcinoma	7
SM-Ca (<1000 μm)	1
SM-Ca (≥1000 μm)	5
MP-Ca	4
Carcinoid	1
Malignant lymphoma	1
GIST	1
Mucosal prolapsed syndrome	1
Mucosa-associated lymphoid tissue lymphoma	1
En bloc resection rate, n (%)	32 (100)

ER alone. The spread of ESD has enabled en bloc resection of relatively large lesions. However, even with ESD, the rate of en bloc resection was less than 90%, and the duration of surgery was as long as about 2 hours, with a substantial incidence rate (about 5%) of complications, such as perforation.[7] Although the risk of development of diffuse peritonitis due to perforation is low in cases of lower rectal lesions, ER, which is a positive pressure procedure, may cause perforation-derived subcutaneous emphysema. In addition, lower rectal lesions are associated with a high risk of postoperative bleeding, and there is an issue of intraoperative pain because the rectum is an organ with a rich sensory nervous distribution. Our method of transanal tumor resection requires anesthesia for its implementation; therefore, the patient suffers no pain during the surgery. With our technique, en bloc resection has been achieved in all patients, and the use of a harmonic scalpel that has better hemostatic properties than ESD devices has enabled us to complete the operation within 30 minutes, on average, without intraoperative bleeding. Because it is easy to achieve total layer resection with our technique of transanal tumor resection, such resection was possible in 3 cases of submucosal cancer and 4 cases of MP cancer in our series of patients. Because this procedure employs equal pressure, no subcutaneous emphysema occurred as a postoperative complication. Although there was a case of postoperative bleeding, the bleeding was arrested successfully by endoscopic measures.

On the other hand, methods of transanal tumor resection include transanal endoscopic microsurgery (TEM)[21,22] and minimally invasive transanal surgery (MITAS).[23]

TEM is disadvantageous in that it is a complicated technique requiring an expensive device and a long time for setup. The surgical duration for TEM is relatively long, about 90 minutes, and the TEM technique requires a steep learning curve. TEM is associated with the risk of bleeding because it uses electric knives for resection. The use of electric knives hardly causes any problem in cases of usual resection in the submucosal layer. However, when total layer resection is intended, electric knives may cause bleeding during surgery because large vessels may be present in the MP in some cases. Therefore, the usefulness of TEM using harmonic long shears was reported.[24] Of course, for lesions of the mid- and upper rectum, TEM is traditionally best suited.

On the other hand, MITAS requires no suturing, because an automatic suture device is used for tumor resection, and can be completed within a short period time, with a surgical duration of about 20 minutes.[23] However, in MITAS, the tumor should be pulled with a thread to carry out tumor resection using an automatic suture device; therefore, the margin of the deep cut end of the tumor may be inaccurate. Furthermore, it is also difficult to remove staples from the resected specimen. We have encountered some cases where surgery was completed in about 15 minutes, whereas removal of staples from the resected specimen required more than 20 minutes.

Our technique of transanal tumor resection has the following advantages: (1) preoperative setup is easy; (2) negative margins can be secured because the tumor is resected while pulling it under direct vision; (3) hemostatic properties of the harmonic scalpel allows surgery free of intraoperative bleeding; (4) the surgical duration is short; and (5) full-thickness resection does not cause subcutaneous emphysema because it is an equal pressure procedure. On the other hand, the drawbacks of

this procedure are as follows: (1) the harmonic scalpel is more expensive than the electric knife; and (2) this technique is restricted to lesions in the lower rectum. The latter issue seems to be less problematic, because SM slight or shallower cancer lesions not located in the lower rectum are associated with a lower risk of bleeding and pain, and can thus be treated by ER, and because SM massive or deeper cancer lesions, which are associated with a better postoperative QOL than lower rectal lesions, can be treated by laparoscopic-assisted anterior resection.

In this series, 4 MP cancers were successfully resected. One of the 4 patients expressed a strong desire to undergo transanal tumor resection, and received postoperative chemo-radiotherapy; currently, over 5 years after the surgery, the patient remains alive, without recurrence. In the remaining 3 patients, this technique was used because the presence of severe comorbidities precluded radical bowel resection plus lymph node dissection, and recurrence was observed in 1 of the 3 patients. The usefulness of local resection combined with postoperative chemo-radiotherapy for SM and MP cancers has also been reported.[25] However, according to Paty *et al*, the local recurrence rate and disease-specific survival rate at 10 years of follow-up are 17 and 74%, respectively, for SM cancer cases, and 26 and 72%, respectively, for MP cancer cases.[26] Appropriate informed consent and due caution are necessary for implementing local resection of SM massive or deeper cancers.

Acknowledgments

The authors have no conflict of interest.

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